

WHAT IS CLAIMED IS:

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1. An electroless copper plating method using a plating solution containing copper sulfate as copper ion sources, and a copper ion complex agent, a copper ion reducing agent and a pH conditioner, wherein said method comprises steps of using the hydroxide of an alkaline earth metal as said pH conditioner to react with sulfuric ions in the electroless copper plating solution into a salt of said alkaline earth metal,

10 removing the precipitate from the plating solution, measuring at least one of the concentration of sulfuric ion and the concentration of oxalic ion in the plating solution and keeping an optimum sulfuric ion or oxalic ion concentration during an electroless copper plating .

15 2. An electroless copper plating method using a plating solution containing copper sulfate as copper ion sources, and a copper ion complex agent, glyoxylic acid or salt thereof as a copper ion reducing agent,

20 and pH conditioner, wherein said method comprises steps of using alkaline earth metal hydroxide as said pH conditioner, precipitating and removing sulfuric and oxalic ions as salts of said alkaline earth metal in the electroless plating solution during electroless

25 copper plating .

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5 3. An electroless copper plating machine using
a plating solution containing copper sulfate as copper
ion sources, and a copper ion complex agent, a copper
ion reducing agent, and a pH conditioner, wherein said
method comprises steps of adding at least one of
alkaline earth metal, alkaline earth metal oxide,
alkaline earth metal hydroxide, and alkaline earth
metal salt (excluding sulfuric salt) into said plating
solution, reacting with and precipitating sulfuric
10 ions as an alkaline earth metal salt, measuring the
concentration of sulfuric ions in said plating
solution, and regulating the concentration thereof to
a preset optimum concentration during electroless
copper plating .

15 4. An electroless copper plating machine using
a plating solution containing copper sulfate as copper
ion sources, and a copper ion complex agent, glyoxylic
acid or salt thereof as a copper ion reducing agent,
and a pH conditioner, wherein said method comprises
20 steps of adding at least one of alkaline earth metal,
alkaline earth metal oxide, alkaline earth metal
hydroxide, and alkaline earth metal salt (excluding
sulfuric salt) into said plating solution, reacting
with and precipitating sulfuric ions or oxalic ion as
25 an alkaline earth metal salt during electroless copper

plating .

5. An electroless copper plating machine using a plating solution containing copper sulfate as copper ion sources, and a copper ion complex agent, glyoxylic acid or salt thereof as a copper ion reducing agent, and a pH conditioner, wherein said device comprises an electroless copper plating bath, a reaction bath which adds at least one of alkaline earth metal, alkaline earth metal hydroxide, alkaline earth metal oxide, and alkaline earth metal salt (excluding sulfuric salt) to said copper plating solution therein to react with and precipitate sulfuric ions and oxalic ion as alkaline earth metal salts in said plating solution, and a filter unit for separating said metallic salt precipitate

6. An electroless copper plating machine using a plating solution containing copper sulfate as copper ion sources, and copper ion complex agent, a copper ion reducing agent, and a pH conditioner, wherein said device comprises an electroless copper plating bath, a reaction bath which adds at least one of alkaline earth metal, alkaline earth metal hydroxide, alkaline earth metal oxide, and alkaline earth metal salt (excluding sulfuric salt) to said copper plating solution therein to react with and precipitate

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sulfuric as an alkaline earth metal salt in said
plating solution, a filter unit for separating said
metallic salt precipitate, means for measuring the
concentration of sulfuric ion in said plating
5 solution), and means for comparing said measured
concentration by a preset reference concentration and
controlling the quantity of said alkaline earth metal,
alkaline earth metal hydroxide, alkaline earth metal
oxide, or alkaline earth metal salt (excluding
10 sulfuric salt) to be added.

7. An electroless copper plating machine using
a plating solution containing copper sulfate as copper
ion sources, and a copper ion complex agent, glyoxylic
acid or salt thereof as a copper ion reducing agent,
15 and a pH conditioner, wherein said device comprises an
electroless copper plating bath, a reaction bath which
adds at least one of alkaline earth metal, alkaline
earth metal hydroxide, alkaline earth metal oxide, and
alkaline earth metal salt (excluding sulfuric salt) to
20 said copper plating solution therein to react with and
precipitate sulfuric as an alkaline earth metal salt
in said plating solution, a filter unit for separating
said alkaline earth metal salt precipitate, means for
measuring at least one of the sulfuric ion
25 concentration and the oxalic ion concentration and

means for comparing at least one of said measured
sulfuric and oxalic concentrations by a preset
reference concentration and controlling the quantity
of said alkaline earth metal, alkaline earth metal
5 hydroxide, alkaline earth metal oxide, or alkaline
earth metal salt (excluding sulfuric salt) to be added.

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8. An electroless copper plating machine using
a plating solution containing metallic ions, an agent
for reducing said metallic ions, and a pH conditioner,
10 wherein said device comprises an electroless copper
plating bath, a reaction bath adding a metal or a
compound containing a metal to said plating solution
to precipitate ions which suppress generation of said
plating metal as metal salts, and a ultra filtration
15 unit for removing said metal salt precipitate.

9. An electroless copper plating machine in
accordance with Claim 5 through Claim 8, wherein said
filtration unit is a cross-flow type ultra filtration
unit or a filter press type ultra filtration unit.

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Product
HYBRID x Alkaline
PXBUP

10. A multi-layer wiring board having insulating
layers and circuit layers accumulated and cemented
alternately whose circuit layers are electrically
connected by copper-plated through-holes which pass
through the insulating layer between said circuit

25 layers or by copper-plated via-holes whose one end is

treat
Independent Claims

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closed, wherein said plating is made by An electroless
copper plating method in accordance with Claim 1—
through Claim 4.

11. A module having one or more semiconductor
elements on said multi-layer wiring board in
accordance with Claim 10.

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